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TENTATIVE

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12.1” XGA

TECHNICAL SPECIFICATION

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AA121XL01

MITSUBISHI ELECTRIC Corp.

Date: Jan.29,’10

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1. APPLICATION

This specification applies to color TFT-LCD module, AA121XL01.

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(1) Standard Usage

Computers, office equipment, factory automation equipment, test and measurement equipment, communications, transportation equipment(automobiles, ships, trains, etc.), provided, however, that operation is not influenced by TFT-LCD directly.

(2) Special Usage

Medical equipment, safety equipment, transportation equipment, provided, however, that TFT-LCD is necessary to its operation.

(3) Specific Usage

Cockpit Equipment, military systems, aerospace equipment, nuclear reactor control systems, life support systems and any other equipment. MITSUBISHI should make a contract that stipulate apportionment of responsibilities between MITSUBISHI and our customer.

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2. OVERVIEW

AA121XL01 is 12.1" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, and backlight unit.

By applying 6 bit or 8 bit digital data, 1024 × 768, 262k-color or 16.7M-color images are displayed on the 12.1" diagonal screen. Input power voltage is single 3.3 V for LCD driving.
The type of data and control signals are digital and transmitted via LVDS interface per Typ. 65 MHz clock cycle.

Driver circuit for LED backlight is not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	245.76(H) × 184.32(V) (12.1-inch diagonal)
Number of Dots	1024 × 3 (H) × 768 (V)
Pixel Pitch (mm)	0.240 (H) × 0.240 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white TN
Number of Color	262k(6 bit/color), 16.7M(8 bit/color)
Luminance (cd/m^2)	1000
Wide Viewing Angle Technology	Optical Compensation Film
Viewing Angle (CR ≥ 10)	–80~80° (H) –80~60° (V)
Surface Treatment	Anti-glare and hard-coating 3H
Electrical Interface	LVDS (6 bit/8 bit)
Optimum Viewing Angle (Contrast ratio)	6 o'clock
Module Size (mm)	260.5 (W) × 203.0 (H) × 9.7 (D)
Module Mass (g)	610
Backlight Unit	LED, edge-light

Characteristic value without any note is typical value.

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3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage for LCD	VCC	0	4.0	V
Logic Input Voltage	VI	–0.3	VCC+0.3	V
Backlight (LED) Current	IF	0	180	mA
Operation Temperature (Panel) Note 1,2)	$T_{op(Panel)}$	–30	80	°C
Operation Temperature (Ambient) Note 2)	$T_{op(Ambient)}$	–30	80	°C
Storage Temperature Note 2)	T_{stg}	–30	80	°C

[Note]

1) Measured at the center of active area and at the center of panel back surface

2) Top,Tstg ≤ 40°C : 90%RH max. without condensation

Top,Tstg > 40°C : Absolute humidity shall be less than the value of 90%RH at 40°C without condensation.

4. ELECTRICAL CHARACTERISTICS

(1) TFT-LCD

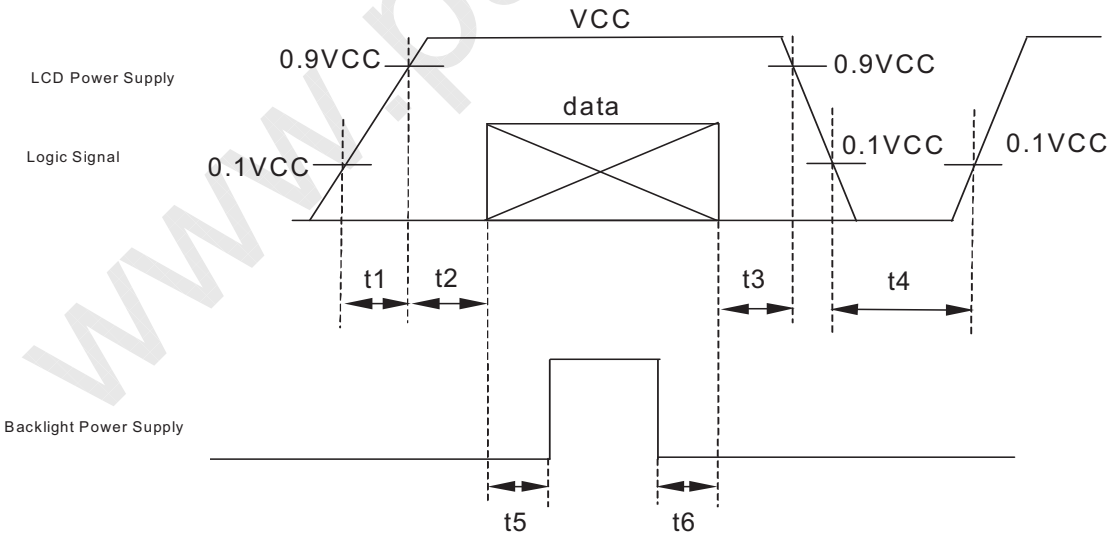
Ambient temperature: Ta = 25°C

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
Power Supply Voltages for LCD		VCC	3.0	3.3	3.6	V	*1)
Power Supply Currents for LCD		ICC	--	320	600	mA	*2)
Permissive Input Ripple Voltage		VRP	--	--	100	mVp-p	VCC=+3.3V
Logic Input Voltage	High	VIH	0.8×VCC	--	VCC	V	MODE, SC
	Low	VIL	0	--	0.2×VCC	V	MODE, SC

*1) Power and signals sequence:

t1 ≤ 10ms
0 < t2 ≤ 50ms
0 < t3 ≤ 50ms

200ms ≤ t4
200ms ≤ t5
0 ≤ t6



data: RGB DATA, DCLK, DENA, MODE, SC

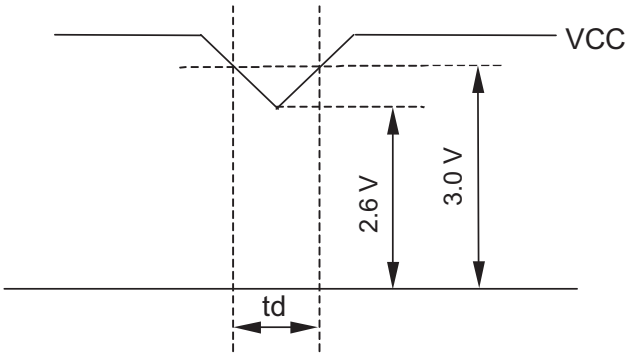
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VCC-dip conditions:

1) When 2.6 V ≤ VCC < 3.0 V, td ≤ 10 ms

2) When VCC < 2.6 V

VCC-dip conditions should also follow the power and signals sequence.



*2) VCC = +3.3 V , f_H = 48.4 kHz, f_V = 60 Hz, f_{CLK} = 65 MHz
Display image at typical power supply current value is 256-gray-bar pattern (8 bit), 768 line mode.

*3) Fuse

Parameter	Fuse Type Name	Supplier	Remark
VCC	FCC16162AB	Kamaya Electric Co., Ltd.	*)

*) The power supply capacity should be designed to be more than the fusing current.

(2) Backlight

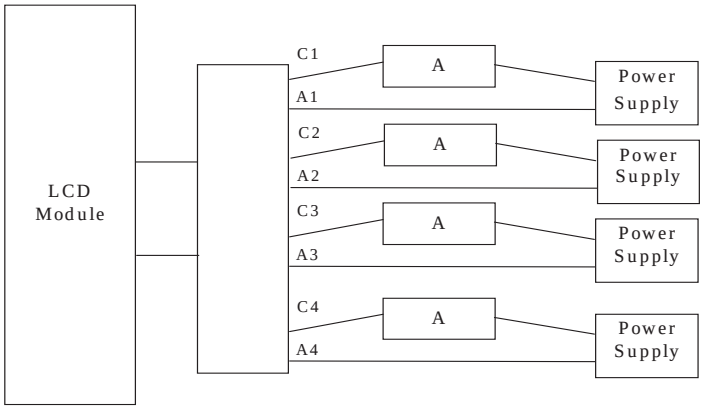
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	Remarks
LED Voltage	VF	--	(18)	23.4	V	IF = 120 mA, Ta = 25°C
		--	--	24.2	V	IF = 120 mA, Ta = 0°C
		--	--	25.2	V	IF = 120 mA, Ta = –30°C
LED Current	IF	--	120	130	mA	*1), *3)
LED Life Time	LT	60000	--	--	h	IF = 120 mA, Ta = 25°C *4), *5), Continuous operation

[Note]

*1) Constant Current Drive

*2) The Voltage deviation between strings: $|V_{fMAX} - V_{fMIN}| \leq 2V$

*3) LED Current measurement method:



*4) LED life time is defined as the time when the brightness becomes 50% of the initial value.

*5) The life time of the backlight depends on the ambient temperature. The life time will decrease under high temperature.

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5. INTERFACE PIN CONNECTION

(1)CN 1(INTERFACE SIGNAL)

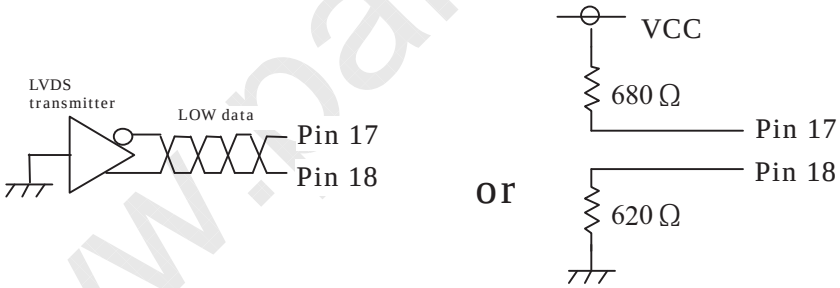
Used connector: 20186-020E-11F (I-PEX)

Corresponding connector: 20197-020U-F (I-PEX), FI-S20S (JAE), FI-SE20ME (JAE)

Pin No.	Symbol	Function (ISP 6 bit compatibility mode)		Function (ISP 8 bit compatibility mode)
		6 bit input	8 bit input	
1	VCC	+3.3 V Power supply		←
2	VCC	+3.3 V Power supply		←
3	GND	GND		←
4	GND	GND		←
5	Link 0–	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
6	Link 0+	R0, R1, R2, R3, R4, R5, G0	R2, R3, R4, R5, R6, R7, G2	R0, R1, R2, R3, R4, R5, G0
7	GND	GND		←
8	Link 1–	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1
9	Link 1+	G1, G2, G3, G4, G5, B0, B1	G3, G4, G5, G6, G7, B2, B3	G1, G2, G3, G4, G5, B0, B1
10	GND	GND		←
11	Link 2–	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
12	Link 2+	B2, B3, B4, B5, DENA	B4, B5, B6, B7, DENA	B2, B3, B4, B5, DENA
13	GND	GND		←
14	CLKIN–	Clock –		←
15	CLKIN+	Clock +		←
16	GND	GND		←
17	Link3–	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7
18	Link3+	See: *2)	R0, R1, G0, G1, B0, B1	R6, R7, G6, G7, B6, B7
19	MODE	Low=ISP 6 bit compatibility mode		High=ISP 8 bit compatibility mode
20	SC	Scan direction control. (Low : Normal , High : Reverse)		←

*1) Metal frame is connected to signal GND.

*2) Recommended wiring of Pin 17,18 (6 bit input)



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(2)CN 2(BACKLIGHT)

Backlight-side connector: SM10B-SHLS-TF(LF)(SN) (JST)
Corresponding connector: SHLP-10V-S-B (JST)

Pin No.	Symbol	Function
1	NC	This pin should be open.
2	NC	This pin should be open.
3	LED C 1	LED cathode 1
4	LED A 1	LED anode 1
5	LED A 2	LED anode 2
6	LED C 2	LED cathode 2
7	LED C 3	LED cathode 3
8	LED A 3	LED anode 3
9	LED A 4	LED anode 4
10	LED C 4	LED cathode 4

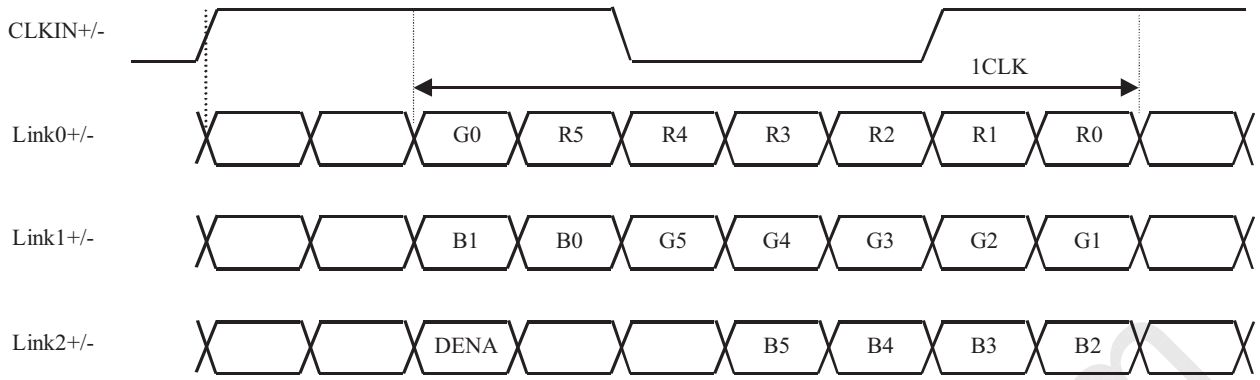
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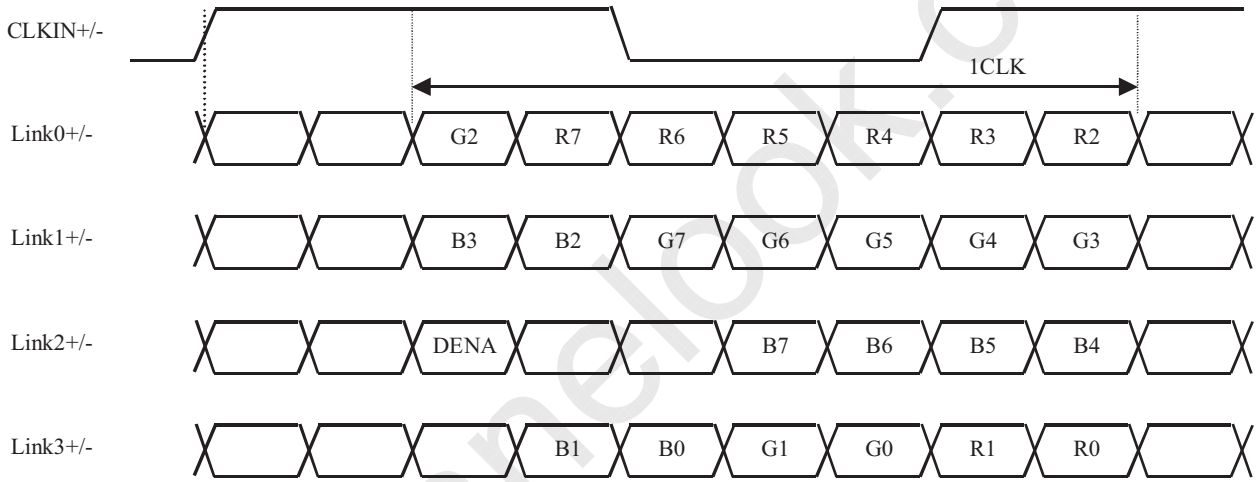
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(3) ISP data mapping

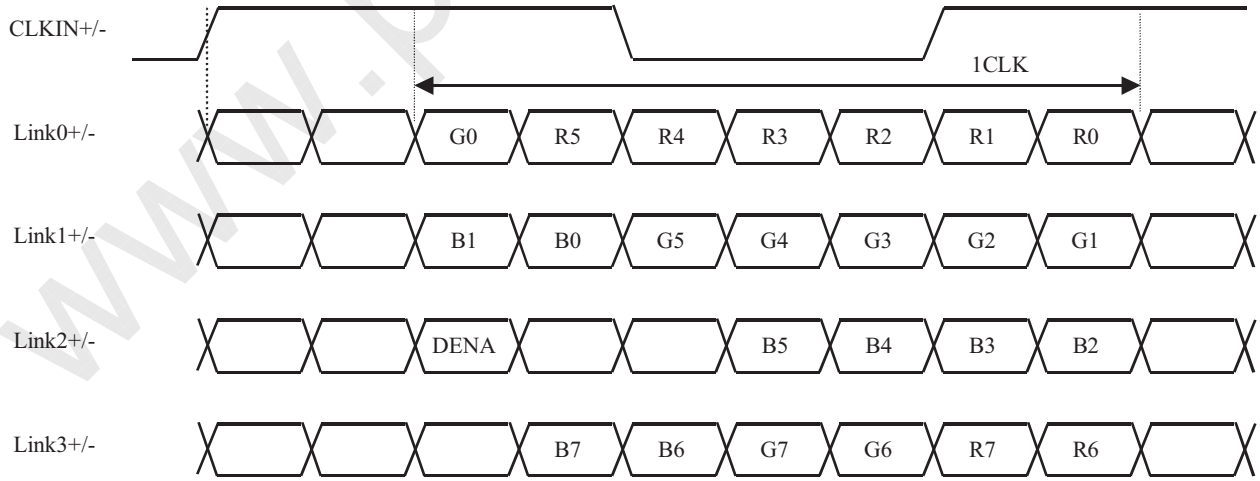
a. ISP 6 bit compatibility mode(6 bit input)



b. ISP 6 bit compatibility mode(8 bit input)



c. ISP 8 bit compatibility mode



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6. INTERFACE TIMING

LVDS transmitter input signal

(1) Timing Specifications

ITEM			SYMBOL	MIN.	TYP.	MAX.	UNIT
DCLK	Frequency		f_{CLK}	50	65	80	MHz
	Period		t_{CLK}	12.5	15.4	20	ns
DENA	Horizontal	Active Time	t_{HA}	1024	1024	1024	t_{CLK}
		Blanking Time	t_{HB}	20	320	--	t_{CLK}
		Frequency	f_H	42.4	48.4	60	kHz
		Period	t_H	16.6	20.7	23.6	µs
	Vertical	Active Time	t_{VA}	768	768	768	t_H
		Blanking Time	t_{VB}	3	38	--	t_H
		Frequency	f_V	55	60	75	Hz
		Period	t_V	13.3	16.7	18.2	ms

[Note]

1) DENA (Data Enable) should always be positive polarity as shown in the timing specification.
2) DCLK should appear during all invalid period.
3) LVDS timing follows the timing specifications of LVDS receiver IC: THC63LVDF84B(Thine).
4) In case of blanking time fluctuation, please satisfy following condition.

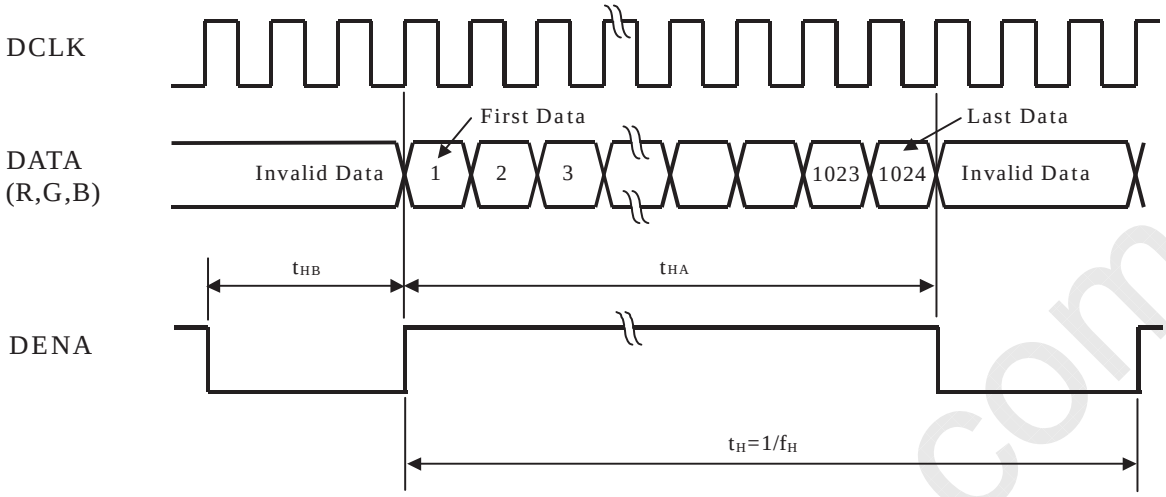
$t_{VBn} > t_{VBn-1} - 3(t_H)$

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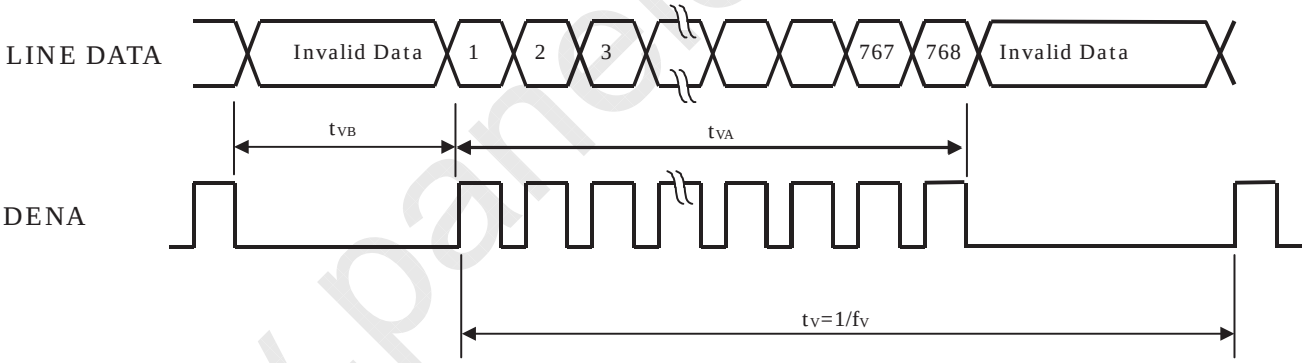
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(2) Timing Chart

a. Horizontal Timing Chart



b. Vertical Timing Chart



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(3) Color Data Assignment

a. 6 bit input

COLOR		INPUT DATA																	
		R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

1) Definition of gray scale

Color (n) ---n indicates gray scale level.

Higher n means brighter level.

2) Data

1:High, 0: Low

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b. 8 bit input

COLOR		INPUT DATA																									
		R DATA								G DATA								B DATA									
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0		
		MSB							LSB	MSB							LSB	MSB							LSB		
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0		
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1		
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1		
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0		
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
RED	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
GREEN	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0		
BLUE	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1		

[Note]

1) Definition of gray scale

Color (n) ---n indicates gray scale level.

Higher n means brighter level.

2) Data

1:High, 0: Low

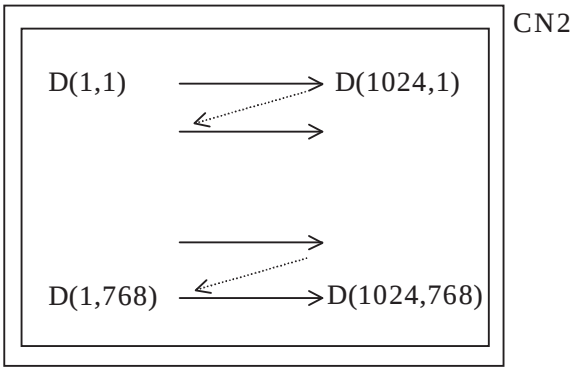
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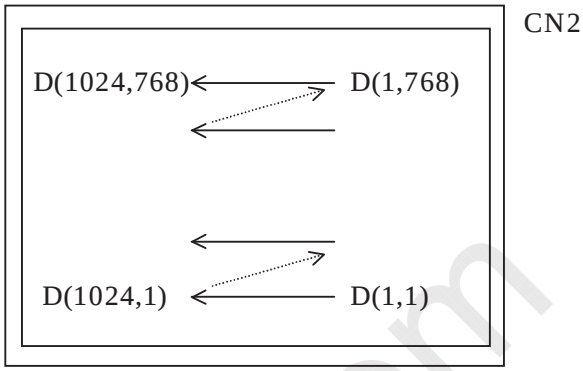
(4) Display Position and Scan Direction

D(X,Y) shows the data number of input signal.

SC: Low



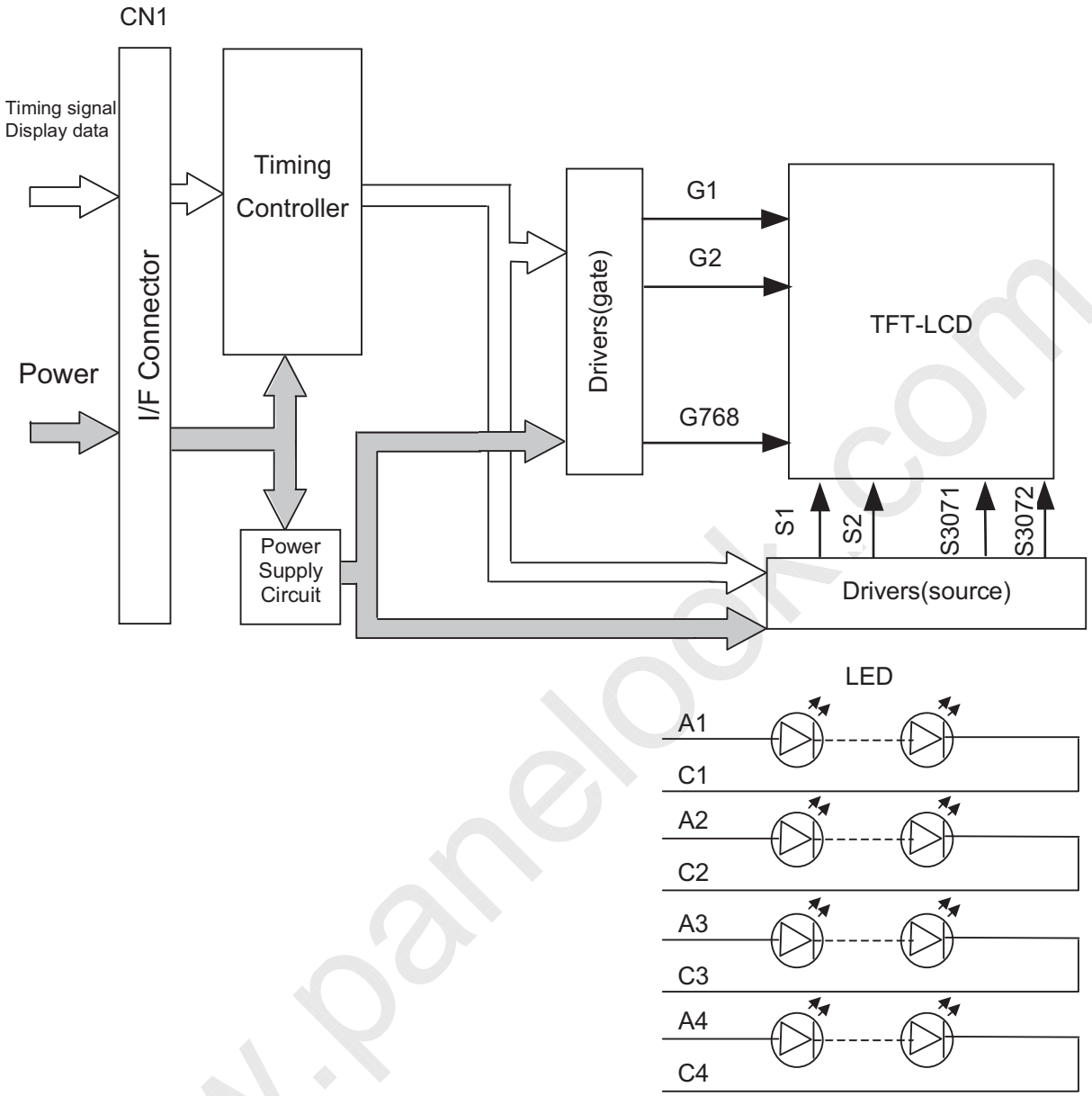
SC: High



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7. BLOCK DIAGRAM

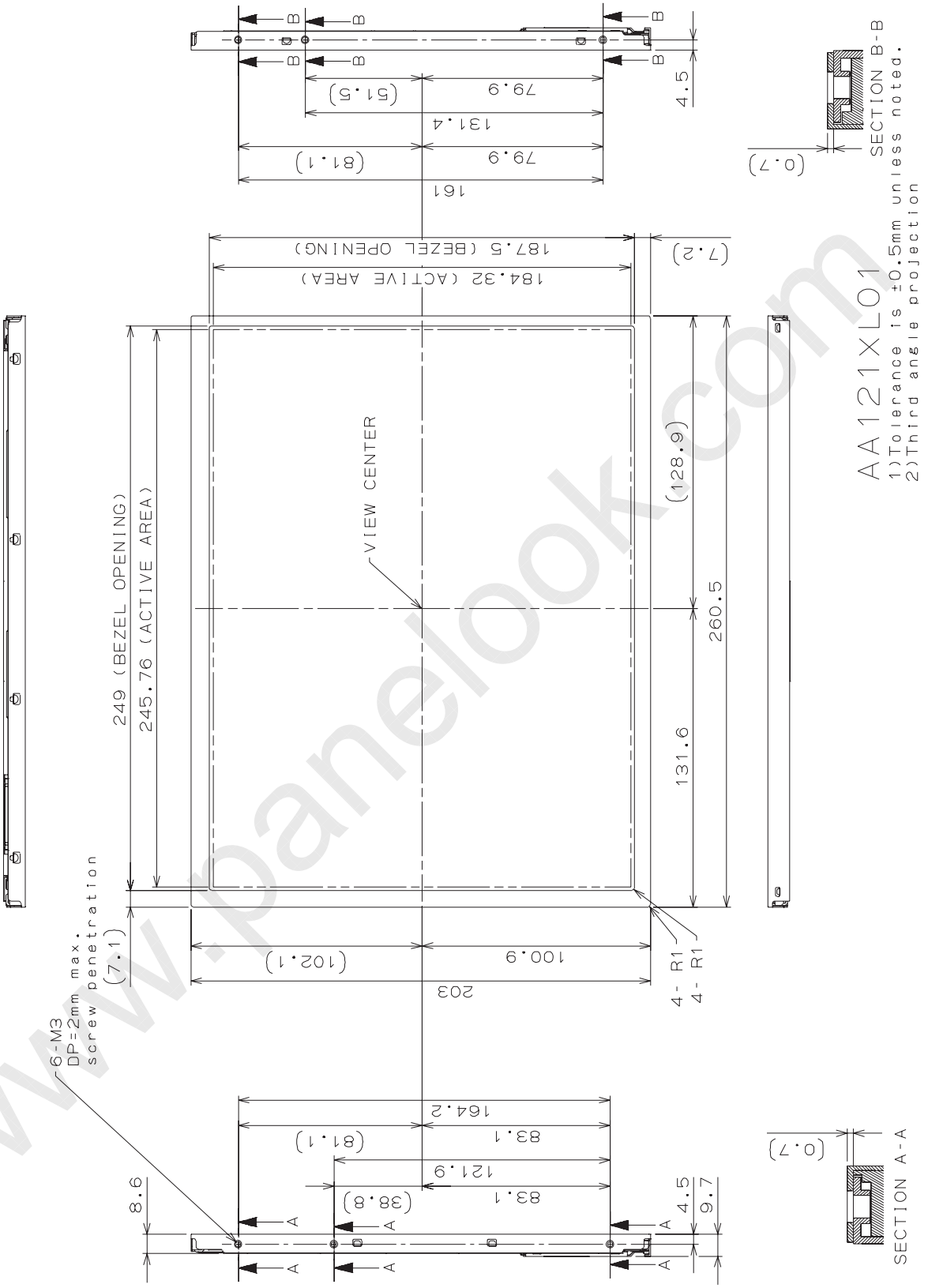


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8. MECHANICAL SPECIFICATIONS

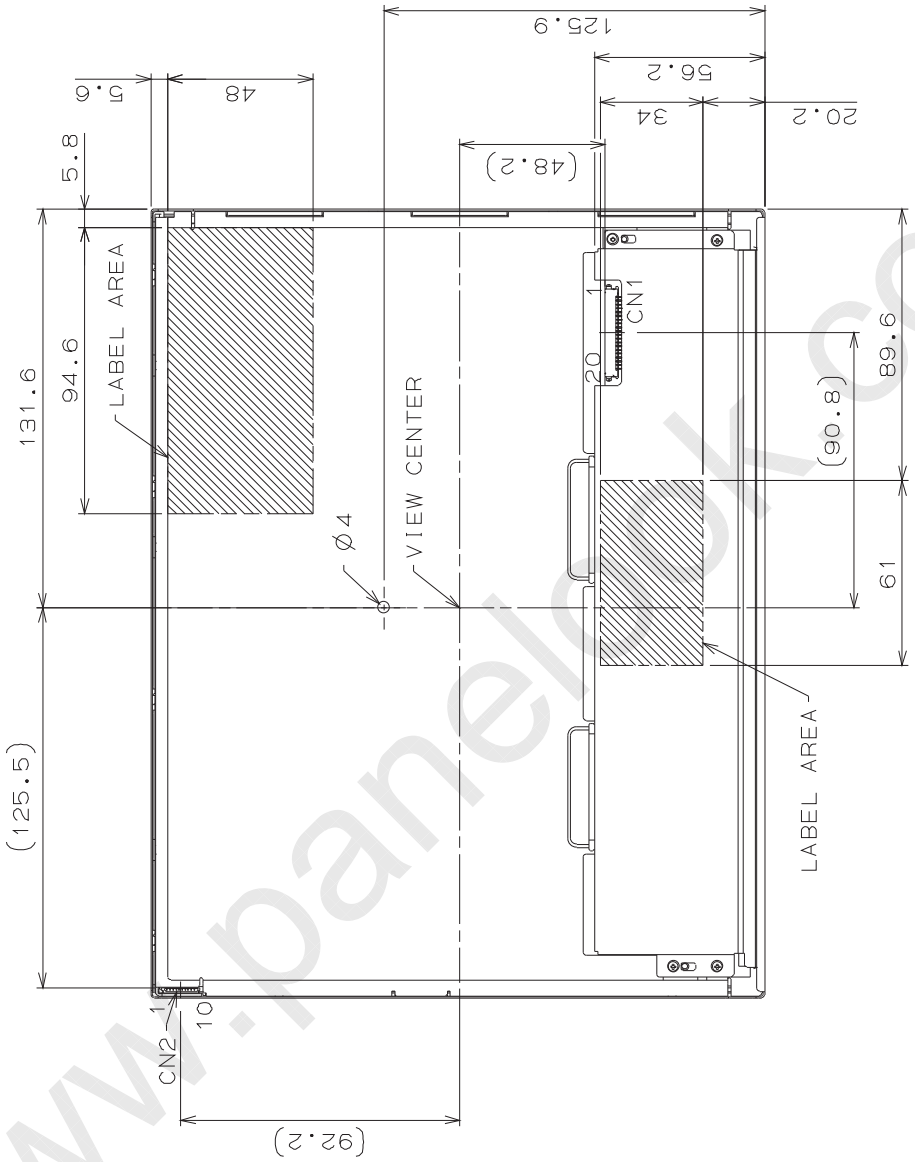
(1) Front Side



(Unit:mm)

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(2) Rear Side



AA121XL01

1)Tolerance is ±0.5mm unless noted.
2)Third angle projection

CN1:20186-020E-11F (I-PEX)
CN2:SM10B-SHLS-TF(LF)(SN) (JST)

(Unit:mm)

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9. OPTICAL CHARACTERISTICS

Ta=25°C, VCC=3.3V, Input Signals: Typ. values shown in Section 6

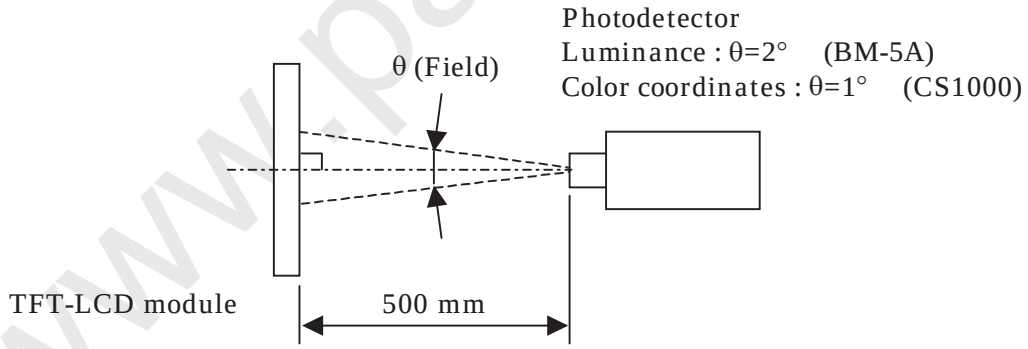
ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT	Remarks
Contrast Ratio		CR	θ_V=0°, θ_H=0°	390	600	--	--	*1)*2)*5)
Luminance		Lw	θ_V=0°, θ_H=0°	800	1000	--	cd/m^2	*1)*5)
Luminance Uniformity		ΔLw	θ_V=0°, θ_H=0°	--	--	30	%	*1)*3)*5)
Response Time		tr	θ_V=0°, θ_H=0°	--	6	--	ms	*1)*4)*5)
		tf	θ_V=0°, θ_H=0°	--	19	--	ms	*1)*4)*5)
Viewing Angle	Horizontal	θ_H	CR ≥ 10	–65~65	–80~80	--	°	*1)*5)
	Vertical	θ_V		–65~45	–80~60	--	°	*1)*5)
Image sticking		tis	2 h	--	--	2	s	*6)
Color Coordinates	Red	Rx	θ_V=0°, θ_H=0°	0.523	0.563	0.603	--	*1)*5)
		Ry		0.309	0.349	0.389		
	Green	Gx		0.311	0.351	0.391		
		Gy		0.510	0.550	0.590		
	Blue	Bx		0.120	0.160	0.200		
		By		0.109	0.149	0.189		
	White	Wx		0.273	0.313	0.353		
		Wy		0.289	0.329	0.369		

[Note]

These items are measured using CS1000(MINOLTA) for color coordinates, EZContrast(ELDIM) for viewing angle and CS1000 or BM-5A(TOPCON) for others under the dark room condition (no ambient light) after more than 30 minutes from turning on the lamp unless noted.

Condition: IF = 120 mA

Measurement method for luminance and color coordinates is as follows.

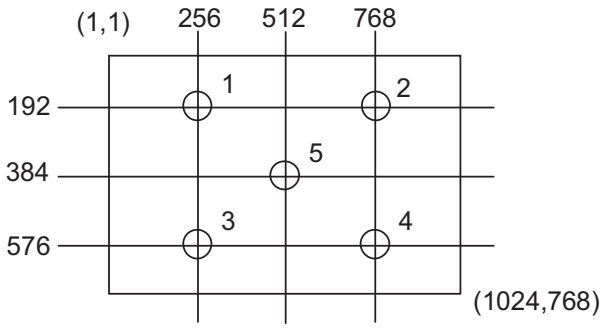


The luminance is measured according to FLAT PANEL DISPLAY MEASUREMENTS STANDARD (VESA Standard).

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*1) Measurement Point

Contrast Ratio, Luminance, Response Time, Viewing Angle, Color Coordinates: Display Center
Luminance Uniformity: point 1~5 shown in a figure below



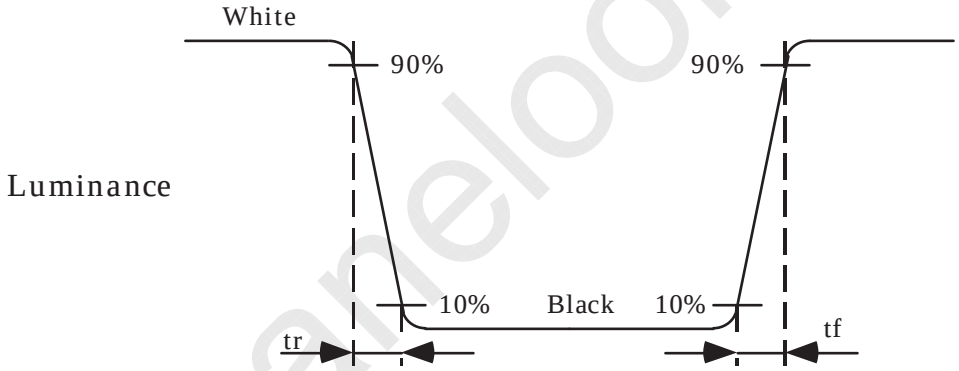
*2) Definition of Contrast Ratio

CR= Luminance with all white pixels / Luminance with all black pixels

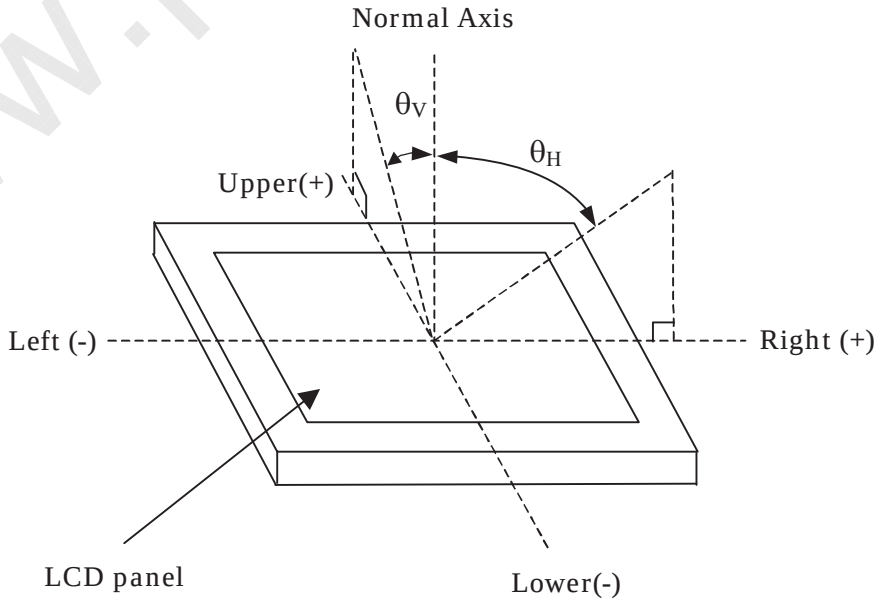
*3) Definition of Luminance Uniformity

$\Delta Lw=[Lw(MAX)/Lw(MIN)-1] \times 100$

*4) Definition of Response Time



*5) Definition of Viewing Angle(θ_V, θ_H)



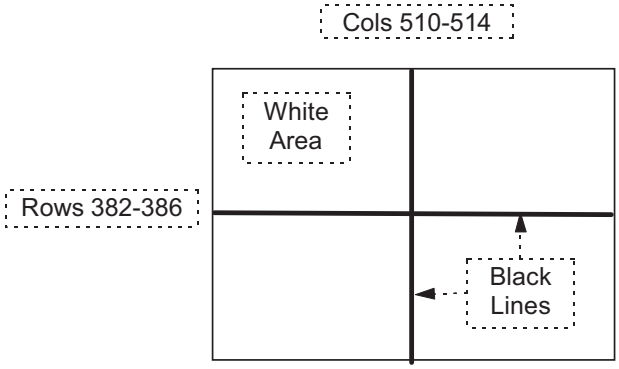
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*6) Image sticking:

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25°C.



TEST PATTERN FOR IMAGE STICKING TEST

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10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

ITEM	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40°C, 90%RH, 240 h (No condensation)
HIGH TEMPERATURE OPERATION	80°C, 240 h
LOW TEMPERATURE OPERATION	–30°C, 240 h
HIGH TEMPERATURE STORAGE	80°C, 240 h
LOW TEMPERATURE STORAGE	–30°C, 240 h
THERMAL SHOCK	–30°C (1h) ~ 80°C(1h), 100 cycles

(2) Shock & Vibration

ITEM	CONDITIONS
SHOCK (NON-OPERATION)	Shock level: 1470m/s^2 (150G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs
VIBRATION (NON-OPERATION)	Vibration level: 9.8m/s^2 (1.0G) Waveform: sinusoidal Frequency range: 5 to 500Hz Frequency sweep rate: 0.5 octave /min Duration: one sweep from 5 to 500 Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3) Judgment standard

The judgment of the above tests should be made as follow:

Pass: Normal display image, no damage of the display function. (ex. no line defect)
Partial transformation of the module parts should be ignored.

Fail: No display image, damage of the display function. (ex. line defect)

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11. OTHER FEATURE

This LCD module complies with RoHS *) directive.

*) RoHS: Restriction of the use of certain hazardous substances in electrical and electronic equipment

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12. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling TFT-LCD products;

(1) ASSEMBLY PRECAUTION

a. P ea e o nt t e LCD o e n o nt n o e t a re a p n tor e e t an 0.5 N . P ea e o not en or ren t e LCD o e n a e n . P ea e o not rop, en or t t t e LCD o e n an n .

. P ea e e n pa o n na or an e t t e o o n e ne .

(a) Ho n a e t e e ne are o a not to p t tre e on LCD an not to ren o e.

( ) Un er te perat re en ron ent, per or an e an e t e o LED a ea orten. en o e n t o r LCD pro t, p ea e on er ra at n eat an ent at on or oo eat ana e ent.

( ) eep ent earan e et een LCD o e a r a e an o n en t e LCD o e o nte . Appro ate 1.0 o t e earan e n t e e n re o en e ta n nto a o nt t e to eran e o LCD o e t ne an o nt n tr t re e t on t e o n .

( ) en o e part , a , FPC a e an err te p ate, are n ta e n erneat t e LCD o e, t ent earan e re re , a 0.5 . T earan e , e pe a , to e re on ere en t e a t ona part are p e ente or EMI o nter ea re.

(e) De n t e LED r er o at on an onne tor po t on are o a not to e tre to LED a t a e.

( ) eep ent earan e et een LCD o e an t e ot er part , a n erter an pea er o a not to nter ere t e LCD o e. Appro ate 1.0 o t e earan e n t e e n re o en e .

( ) To a o o a e e at on/ e rea e o te perat re, on er n o at on o eat n e e ent, eat re ea e, t er a e n o e one.

. P ea e o not p or rat LCD pane r a e t an t n ar . An o not o LCD pane r a e to n t are an . (Po ar er , r a e o LCD pane ea to e a e .)

. P ea e pe o LCD pane r a e t a or ent otton or o t ot n a e o t e n o e .

e. P ea e pe o rop o a e e e a a an ater on LCD pane r a e e ate . T e t a a e to a e pane r a e ar at on an o or an e.

. P ea e o not ta e a LCD o e to p e e an re on tr t t. Re o n an re on tr t n o e a a e t e not to or e .

. P ea e o not to eta ra e t are an an o e o e. A o or an e o t e eta ra e an appen r n a on pre er at on o o e LCD o e .

. P ea e an e eta ra e are e a e e e o eta ra e er arp.

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. P ea e onne t t e eta ra e o LCD o e to ND n or er to n e t e e e t o e terna no e an EMI.

. Be re to onne t t e a e an t e onne ter orre t .

(2) OPERATING PRECAUTIONS

a. P ea e e re to t rn o t e po er pp e ore onne t n an onne t n na np t a e.

. P ea e o not an e ar a e re tan e ett n n LCD o e. T e are a te to t e o t ta e a e. I t e are an e , t t appen LCD oe not at t e ara ter t pe at on.

. T e nter a e na pee er . P ea e pa attent on to tran on ne e n an ot er pee na pre a t on to at na pe at on.

. A on en at on t appen on t e r a e an n e o LCD o e n a e o en an e o a ent te perat re. P ea e ta e are o a not to a e an a a e ent one on (1) .

e. P ea e pa attent on not to p a t e a e pattern or er on t e. I a e t t on LCD. E en a e t n appen , t a appear a t e operat on t e pro ee .

. P ea e o e t e a e a e n tr t on a one e n prepare or or nar e e tron pro t .

(3) PRECAUTIONS WITH ELECTROSTATICS

a. T LCD o e e CMOS IC on r t oar an TFT LCD pane , an o t ea to e a e te e e tro tat . P ea e e are t e e tro tat t e a o o r o onne t n to t e ro n an o on.

. P ea e re o e prote t on er o ro t e r a e o LCD o e to pre ent ro e e tro tat o rren e.

(4) STORAGE PRECAUTIONS

LCD o e tore n t e roo te perat re en ron ent t nor a t . T e LCD n entor o e pro e e r t n r t o t et o .

(5) SAFETY PRECAUTIONS

a. en o a te a a e or nne e ar LCD , t re o en e to r LCD nto p e e an a t e o t o ent a a etone an et ano , o ater e rne .

. I an ea o to a a a e a e an o e n onta t t t e an , a o t oro t oap an ater.

. Be re to t rn o t e po er pp en n ert n or onne t n t e LED a t a e.

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. LED r er o e e ne are to t or top t n t on en o er rrent ete te on t e LED.

(6) OTHERS

a. A tron n ent t nto LCD pane a a e eter orat on to po ar er , o or ter, an ot er ater a , e ra e t e a t o p a ara ter t . P ea e o not e po e LCD o e n er tron U tra o et ra or a on t e.

. P ea e pa attent on to a pane e o LCD o e not to onta t t ot er ater a n pre er n t a one.

. For t e pa a n o an n , p ea e ee an o e t t e pa a n pe at on ata eet.

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